



**NETHERLANDS
ZOOLOGICAL
SOCIETY**

**ZOOLOGICAL
STATION
DEN HELDER**

ANNUAL REPORT 1959

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Marine research in the Netherlands is carried out by the following Institutions:

Zoological Station of the Netherlands Zoological Society at Den Helder. Marine biological and hydrographical research. University extension work. Expenses paid by the State: Ministry of Education, Arts and Sciences.

Department for estuarine research (Delta-onderzoek) of the Hydrobiological Institution. Its task is to study the biological changes in the estuarine waters of the province of Zeeland, as well as their causes. These changes will be due to the closing of these waters in the near future. The Hydrobiological Institution itself (which is a fresh water station) is at Nieuwersluis (province of Utrecht), the Department for estuarine research is at Yerseke (province of Zeeland). The Institution (including its Department) is run by the Royal Netherlands Academy of Sciences at Amsterdam. The expenses are paid by the State: Ministry of Education, Arts and Sciences.

Government Institution for fisheries research at IJmuiden. Sea, coastal and inland fisheries. Fish preservation. Oyster research at Bergen-op-Zoom and, temporarily, at Wemeldinge for studies in connection with the closure of the estuaries in the province of Zeeland. Ministry of Agriculture and Fisheries.

Oceanographical Department of the Royal Netherlands Meteorological Institute at De Bilt (Utrecht). Physical oceanography and maritime meteorology. Ministry of Defense.

Hydrographical Department of the Navy. Office at the Hague. Bathymetrical surveys. Study of tides. Chart construction. Ministry of Defense, Dept. of the Navy.

Research Department of the Rijkswaterstaat. Headoffice at the Hague, research departments scattered. Current, tides, sedimentation, erosion, reclaiming of land. Ministry of Traffic and Waterways. The service of the Zuiderzee works, with office at the Hague, under whose direction reclamation of land in the Zuiderzee is organized, is under the junction of the same Ministry.

Geological Institute of the State University at Groningen. Marine geology.

ANNUAL REPORT
OF THE ZOOLOGICAL STATION OF THE
NETHERLANDS ZOOLOGICAL SOCIETY
FOR THE YEAR 1959

Research at the Station in 1959 was continued as before and in the meantime the plans for its extension were developed further. Some data of interest are dealt with in the following pages.

In the previous Annual Report a detailed account was given of the experiments by Mr. DE BLOK on the influence of lunar, or tidal, changes on the periodicity of reproduction of marine animals.

Just as in 1958 the oyster *Ostrea edulis* and the sea-urchin *Psammechinus miliaris* showed satisfactory reproduction, but the data obtained so far do not throw any light on the relation between the time of spawning and the external conditions as caused by the tidal apparatus. It appeared, however, that *Psammechinus miliaris*, which in 1959 showed many peaks in its spawning, for its reproduction greatly depended on the sort of food it was offered; in short, a diet of mussel-flesh caused spawning, while sea-lettuce did not. — *Teredo navalis*, the shipworm, produced larvae all through the summer, but the peaks did not show any connection to lunar rhythms, whether natural or artificial. — The Queen scallop *Pecten opercularis* and the worm *Spirorbis borealis* hardly produced eggs. — As concerns the mussel, last year the unexpected result was mentioned that a species like the oyster, which is more particular as to its environment than the mussel, produced huge numbers of larvae, while the mussel did not spawn at all. In order to get insight into the factors that favour reproduction Mr. DE BLOK tried to make *Mytilus* spawn in separate experiments under daylight conditions instead of under artificial light. This was not a success. Neither were better results obtained by producing strong water movements, or offering yeast, powdered liver, *Chlamydomonas* or nutritive natural seawater instead of the Chrysophycean *Phaeodactylum tricornutum* as a food. Adverse factors may have been the growth of algae and high temperatures, the latter being for some time as high as 21–22° C.

Some improvements were made in the existing tide-apparatus. Three new experiments were started, in which certain aspects of semi-monthly emergence will take effect.

Mr. CREUTZBERG, in 1959 in his 5th and last year of service with the Netherlands Organization for Pure Research, continued his study of the method of orientation used by elvers in the open sea. After it had been found in previous years that the elvers use ebb and flood for

transportation it was proved in 1958 that they do not distinguish these by differences in salinity. Experiments carried out in the end of 1958 and in 1959 indicated that the essential factor must be a special smell, which is inherent to inland water. The influence of such inland water may be reduced by filtration over coal. The elvers still perceive differences in concentration of smell with a rather strong dilution of the inland water. Furthermore, experiments proved that the gradual decrease in concentration of smell, as it must occur during flood, makes the elvers leave the bottom so that they are swept along by the current, while a gradual increase in concentration of smell causes them to go down to the bottom. In the latter case they orientate themselves against the current as long as it is not too strong. When the current increases they press themselves against the bottom so that they maintain their position. All this means that marine transport at higher levels apparently takes place as a reaction to the perception of a decrease in concentration of smell, while orientation against the current near the bottom apparently takes place as a reaction to the perception of an increase in concentration. A note on these new results appeared in *Nature*, Vol. 184, p. 1961-1962, 1959.

In 1959 Mr. WESTENBERG finished his theoretical contribution on the persistence of population systems, which is to appear in *Acta biotheoretica*, Vol. 13. The lines of thought of Mr. WESTENBERG are purely deductive. They deal with the question how it may be that different populations may continue to co-exist. Two aspects may be conceived, which are able to ensure persistence: 1. constancy, 2. periodical changes in environment. In the first case the populations are constant, or they oscillate around a constant situation. The starting point of Mr. WESTENBERG is the consideration that to ensure a constant situation first of all the prey- or food-population must have a certain density, which is connected with the efficiency in predation, not with the numbers of consumers. To obtain this constancy, however, the consumer population must also have a certain strength, which fits the yield, the birthsurplus, of the prey population, which surplus in its turn is dependent on the prey density. This premise was, in a less general form, already formulated by NICHOLSON in his treatise on the relation between parasite and host. - Furthermore, Mr. WESTENBERG reasons that this principle, with certain peculiarities, also applies to the components of a food chain. Finally, he extends his speculations to two or more consumers predating on the same species, and to different prey species eaten by the same consumer. He arrives at the conclusion that the latter cases only produce steady systems in the presence of density-dependent factors. - As regards persistence without constancy the line of thought is that periodical changes in environment, which involve a

different resistance of two species against adverse climatic influences or seasonal displacements, have such a reducing effect on the gaining species that now the losing species is temporarily at a premium. It is a pity that it is so difficult to bridge the gap between such purely theoretical lines of thought and those of the experimental and other more practically minded population ecologists, but as theoretical trends of thought are more and more incorporated in speculations of experimental ecologists one may hope that in due time this difficulty will be overcome.

These last few years Mr. WESTENBERG studied in his leisure hours the geographical changes in the northern part of the province of North Holland since the 15th century. This contribution is now completed and is to appear in *Verhandelingen van de Koninklijke Nederlandse Akademie van Wetenschappen*, 1961.

Mr. DUDOK VAN HEEL devoted part of his time to working out the data already mentioned in the previous Annual Report on the accuracy of perception of the direction of sound in the porpoise (*Phocaena phocaena*). A note on this subject appeared in *Nature*, Vol. 183, p. 1063, 1959. Mr. VAN HEEL also read a paper on this subject at a meeting of the Netherlands Zoological Society and showed there the film made by Mr. PFEIFFER, Netherlands Educational Film. This film was also shown at a symposium of the Royal Society held on 15th March in London on the subject of "The Ear under Water", which Mr. VAN HEEL attended.

Towards the end of the year Mr. VAN HEEL started an investigation on the influence of light and gravity on *Littorina obtusata*, with the intention of adding to the observations by JANSSEN on the interference of light and gravity, and at the same time of entering further into the conclusions by FRÄNKEL concerning the behaviour of *Littorina neritoides*. It is still too early to say more here about this investigation. Mr. VAN HEEL was also occupied in the registration of special catches, as will be referred to below.

Mr. DRAL spent the early months of 1959 in working out the electron-microscope observations which, thanks to Mr. W. G. BRAAMS, Leyden, could be made in 1956 (see our Annual Report for that year) on the structure of the latero-frontal epithelium of the gill in *Mytilus*. This epithelium is set with heavy brushes or cirri: one cirrus a cell. When moving backward and forward they behave like stiff sticks beating to and fro in the current produced by the lateral cilia. They catch pieces of food, which stick to them, and pass them on to the frontal cilia. The cirri are over 30 micron long and very stiff. Each cirrus is in fact a plate in the shape of a triangle with a very pointed top. This plate consists of two rows of about 22-25 cilia each, the structure of which is in no

way different from that of cilia described by other authors. The basal granula of the cilia in the same row are apparently very solidly connected, while connections also exist between the granula of cilia of this and the opposite row. From the basal granula intercellular fibrillae extend into the cell and past the nucleus; some contact the latter, a point which was often doubted. We hope that in future it may be possible to check these data with more material.

Mr. DRAL resumed his research on the feeding mechanism of the mussel after having set up an improved experimental apparatus. During the time that no very small, still transparent young mussels were available he could continue his observations by using *Lasaea rubra*, a small mollusc, of which the Director of the Laboratory of the Marine Biological Association, Plymouth, kindly put a number of specimens at our disposal (see E. OLDFIELD in Proc. Malacol. Soc. London, Vol. 31, p. 226-249, 1955).

Thanks to the improved apparatus the frequency of beating of the lateral cilia could be measured over very short periods. It appeared that even under what seemed to be constant conditions this frequency is changing all the time and even interrupted by shorter or longer pauses. At higher concentrations *Chlamydomonas* and *Chlorella* cause a distinct decrease in the frequency of beating of the lateral cilia. One certainly gets the impression that these cilia and also the latero-frontal ones are under the control of the nervous system, which so far it has not been possible to confirm. In this connection the recent publication of AIELLO, in Physiological Zoology, Vol. 33, p. 120-135, 1960, is of much interest.

Assisted by Mr. DE VRIES, Mr. DRAL once more investigated the changes in the light requirements of mussel larvae during the period of growth. This work intended to fill a gap which had turned up when studying the data of Mr. NUBOER. Moreover, it added to the results obtained at the time by Mr. AL KHOLY for the larvae of *Littorina littorea*.

As experimenting with these larvae is very difficult on account of their minute size (100-300 micron) the natural distribution in the sea at day and at night was again taken as a starting point, notwithstanding the drawbacks of this method, caused by the strenuous and time consuming counting and measuring of some 3800 larvae. On 4-5 May water samples were taken at a certain locality at sea at depths of 0, 4, 8, 12 and 17 m. The date was chosen in such a way that still (low) water occurred at noon and at 12.30 in the night. The day was sunny, the night was very dark, the difference in illumination could not have been greater. Both times there was a slight breeze. Counting and measuring, completely done by Mr. DE VRIES, revealed that the young larvae (below 120 micron) at daytime had a pronounced maximum in the

upper half of the water column, while at night they were more or less distributed over the whole column, with a gradual increase to the bottom. This may probably mean that the young *Mytilus* larva is one of those animals which require so much light that during the darkest part of the night the light is too weak to keep them near the surface, so that they gradually sink.

Furthermore, the observations showed that the older larvae had their daytime maximum at a slightly lower depth than the young ones, a fact that may be explained by assuming that they need less light than the young ones do. The nightly maximum of these older animals was situated deeper than their daytime-maximum, but it was situated less deep than with the younger animals. It looks as if the animals did go down during the night, but not as far as the young ones did. We wonder whether this may have to do with the lower requirements of light intensity, so that at night the light kept them longer in the upper layers.

It must be stressed that these conclusions can only be preliminary, since they are based on a single series of data. They are supported, however, by data on the larvae of *Littorina littorea*, which, from young to old, also show the principle of changing requirements as to illumination, though in a different way.

Mr. H. L. DE BEAUFORT continued his research mentioned in the previous Annual Report, on the cause of the appearance of a certain colour pattern in *Sepia officinalis*, the common cuttlefish. It was described in the Annual Report for 1956 that there is a connection between the extension of the white colour patches on the back of *Sepia* and the amount of white, or another bright colour, which is present on the bottom. One is tempted to conclude that the white patches are meant to make the animals less conspicuous. At the same time it appeared in 1956, however, that the extent of white on the back was also influenced by the presence of the observer, or the use of objects which probably scared the animal. In 1958, in consultation with Prof. BAERENDS, Mr. DE BEAUFORT collected quantitative data on the probable influence of scaring objects. This was effected, while white plates of various sizes made part of the bottom, by the use of blackened plates of various sizes, which were passed over the animals. The reactions of *Sepia*, however, did not show any clear-cut tendency and differed greatly from one animal to another. The experiments were repeated in 1959, employing an improved method, but again the results were not convincing. All the same, it was evident that the activities of the investigator at the beginning of a set of experiments, such as directing the animals to a certain spot, contributed greatly to the appearance of white patches on the back. Mr. DE BEAUFORT intends to collect quantitative data on this subject during the next season. Perhaps we may conclude from the experi-

ments that a *Sepia* lying on the bottom is on the whole sooner stimulated by a white colour in the bottom if it is scared than if it is not.

Early in the year Mr. H. C. OBREEN, Utrecht, wound up his research on the influence of current velocity on the growth of the oyster. This research was already mentioned in the previous Report; it deals with a very complicated problem, the difficulties of which have now been realized more fully than ever.

Mr. C. DAVIDS, Amsterdam, came to Den Helder to study the influence of the concentration of a suspension on the percentage of matter held back by the mussel. The work will be continued in 1960 and the results will be dealt with in the Annual Report on that year.

In consultation with Prof. LEVER, Miss M. C. COPPOOLSE of the Free University, Amsterdam, spent a long summer (4 May – 17th October) in Den Helder, studying the occurrence of neurosecretory cells in the ganglia of the prosobranchiate *Crepidula fornicata* L., the so-called slipper. Neurosecretory cells were found in the cerebral, right pleural*, pedal, supra-oesophageal and visceral ganglia; it appears that they are widely scattered. It was disappointing that fixation difficulties made it impossible to prove any connection between activity of the neurosecretory cells and gametogenesis. It did not become quite clear why fixation should be so difficult, but it appeared that in all cases the fixatives had to be prepared with seawater. Of them BOUIN-seawater gave the best results.

Mr. VERWEY extended his trains of thought on the orientation of migrating water animals to brackish and freshwater species. He read a summary on this subject to the Oceanographic Congress in New York. On the occasion of the opening of the new "Biologische Anstalt" at Heligoland he gave a short lecture on some questions connected with the movements and orientation of the shrimp, *Crangon crangon*.

As usual this report includes a list of species which are of interest because of their distribution or otherwise.

Of the southern species, reaching the Dutch coast by way of the Straits of Dover, *Sepia officinalis*, the common cuttle, was rather numerous. Especially the late occurrence of firstyear, but also of older animals, in autumn was striking. Firstyear animals had their maximum in October instead of in August and the species was caught in fair numbers also thereafter, even till within February. Their late occurrence in 1959 was certainly due to the very mild autumn of that year. – It should be mentioned that the catches of the black seabream (*Spondylusoma cantharus*) now known for the Netherlands were enumerated by A. E. HOFSTEDE in Visserijnieuws, Vol. 12, p. 18–19, 1959.

* Fixation of the left pleural ganglion was found to be practically impossible.

As concerns the species entering the North Sea by the northern route, 1959 was remarkable for the fact that not a single Ray's bream (*Brama rayi*) was brought in by fishermen. A novelty is the catch, in November 1959, of a female eagleray, *Myliobatis aquila*, caught near West-Hinder lightvessel in the southern funnel of the North Sea. Apparently, 9 specimens of this southern species are now known from the western part of the English Channel, 5 from the British Westcoast, 9 from the East-coast of Scotland, 1 from Oslofjord and 2 from off Norfolk. It seems likely that we are dealing with a species here that enters the North Sea mainly around Scotland. In late autumn those species often reach the southern North Sea, as also holds for the basking-shark, *Selache maxima*, the sun-fish *Mola mola*, the skipper *Scomberesox saurus*. For the sake of completeness it should be mentioned that on the 29th January 1960 another specimen of *Myliobatis aquila* was caught, this time west of Texel.

Among the species which in the North Sea have a more northern than southern distribution the list mentions *Argentina sphyraena*. According to the fisherman who brought it in it was caught off Callantsoog on April 2. Since cutters from Den Helder, fishing far from home, may occasionally land northern species like *Argentina silus*, *Chimaera monstrosa* and other ones, the possibility can not be excluded that the locality name is wrong, but we have not the least indication in this direction. We do not know what is considered the southern limit of this species in the North Sea; it seems worth while to pay attention to it.

A remarkable fact is that in January-February large numbers of the four-bearded rockling, *Onos cimbrius*, were caught outside the Texel inlet. Up to now this species used to be caught farther to the north. — Since we put a premium on *Cottus bubalis*, the longspined sea-scorpion, a species which is still considered rather uncommon in the Netherlands, we obtained 18 specimens in November.

A specimen of *Maurolicus mulleri* was caught off Petten on 2nd April, 1959. *M. mulleri* is evidently a pelagic deep-sea fish which in winter or spring — with us mostly in March-April, near the east coast of England and Scotland in January-March (see Jenkins) — is found in more shallow waters and is then often washed ashore. VIERGEVER enumerated 6 finds from 1948 to 1954 (Het Zeepaard, Vol. 15, p. 35-36, 1955). After that, one specimen on 21st March 1958 (near Texel), and the above specimen, came to our knowledge.

As will be seen hereafter, the Zoological Station secured the services of a fisherman from South Texel, by name of BEUMKES. He is a specialist in the so-called kom-fishing. A kom is a set of compartments of standing nets, fastened to long poles which are driven into the bottom. The kom is constructed in such a way that a fish may enter it, but has

Species	Sex; Size (cm)	Locality
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA VIA DOVER STRAIT		
<i>Raia montagui</i>	♂, ♀: 7 specimens of 32–61 cm length	Off Texel, Den Helder and Petten; Texel Hole, Borkum stones
<i>Raia brachyura</i>	♂ 61, ♀ 75	Pit buoy 1 and off Petten
<i>Raia naevus</i>	living	Texel Hole
<i>Raniceps raninus</i>	living, about 7–10 cm	Off Texel, off Den Helder, off Petten
<i>Hippocampus europaeus</i>	living, about 10 cm	7 miles NW of Scheveningen
<i>Spondyliosoma cantharus</i>	♂ 40; 38	Texel Hole, Black Bank, Buoy Silverpit-Texel nr. 4, Hollands Diep
<i>Blennius pholis</i>	living	Sea-dike Den Helder
<i>Blennius gattorugine</i>	living	Marsdiep, depth 11 m
<i>Trigla cuculus</i>	♂, ♀: 22.5–30	Tea Kettle Hole, Texel Hole
<i>Spinachia spinachia</i>		SW-ern Waddensea, Molengat
<i>Sepia officinalis</i>		Surroundings of Den Helder
<i>Octopus vulgaris</i>		West of Borkum stones
MIGRANTS SUPPOSED TO HAVE ENTERED THE NORTH SEA VIA THE NORTHERN ENTRANCE		
<i>Myliobatis aquila</i>	♀, total length 102, up to anus 34, width 63 cm	Near Westhinder lightvessel
<i>Scomberesox saurus</i>	♂, ♀, 32–38.5	Stranded near Den Helder
NORTHERN SPECIES, RARE IN THE SOUTHERN NORTH SEA		
<i>Raja radiata</i>	♂ 51; about 50	Near Pit buoys 1 and 2
<i>Argentina sphyraena</i>	13.7	Off Callantsoog, see text
<i>Maurolicus mulleri</i>	7	Off Petten
<i>Onos tricirratulus</i>	living	Haaks Grounds
<i>Onos cimbrius</i>	10–17	Haaks Grounds and off Texel
<i>Anarhichas lupus</i>	50	Pit buoy 5; Terschelling bank
<i>Cottus bubalis</i>		Environment of Den Helder
<i>Hyas coarctatus</i>		Buoy 4 on Silverpit-Texel route; Terschelling bank
<i>Eledone cirrosa</i>		Pit buoy 4; Terschelling bank; Tea Kettle Hole
SPECIES WITH DISTRIBUTION UNCERTAIN		
<i>Alopias vulpes</i>	♀ ♀ 200, 435	Molengat and off Callantsoog
<i>Lamna cornubica</i>	♀ 140	Off Callantsoog
<i>Labrus berggylta</i>	living	Off Texel

Numbers per month

	F	M	A	M	J	J	A	S	O	N	D
5	6	2	1	2	1	—	—	1	—	—	2
—	1	—	1	—	—	—	—	—	—	—	1
—	—	1	—	—	—	—	—	—	—	—	—
4	3	6	3	—	—	—	—	—	—	3	—
—	—	—	—	—	—	1	—	—	—	—	—
1	1	—	—	—	—	—	—	—	1	1	1
—	—	—	—	24	8	—	—	—	6	—	—
1	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	4	12	20	4	—	—	—	—
—	1	1	—	—	—	—	—	—	—	—	—
—	—	—	7	113	26	1	1	2	129	11	7
—	—	—	—	—	—	—	1	—	—	—	—
—	—	—	—	—	—	—	—	—	—	1	—
4	—	—	—	—	—	—	—	—	—	—	1
—	4	6	—	—	—	—	—	—	—	—	—
—	—	—	1	—	—	—	—	—	—	—	—
—	—	—	1	—	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—	—	—	—	—
3	26	8	3	—	—	—	—	—	—	2	1
—	1	1	—	—	—	—	—	—	—	—	—
—	—	1	2	—	—	—	—	1	—	18	7
—	—	1	—	—	—	—	—	1	1	—	—
—	—	1	1	—	—	—	—	—	1	1	—
—	—	—	—	—	2	—	—	—	—	—	—
—	—	—	—	1	—	—	—	—	—	—	—
—	—	—	1	—	—	—	—	—	—	—	—

trouble in finding its way out. The kom is emptied at still water. We want BEUMKES to fish for us and to use his results for scientific work. BEUMKES is the last kom-fisherman in the Marsdiep. Originally, the aim of this fishing method was to catch the Zuyderzee-herring together with the garfish; as the herring vanished about 1940 it was succeeded by the horse-mackerel, *Caranx trachurus*, but the profits of this fishing went steadily down and in the end BEUMKES too thought of giving up this work.

It is of importance to us to make BEUMKES science-minded. Of course we are not especially interested in fish for consumption and we try to get him to put his technical experience and skill at the service of scientific research. Besides, it is much easier now to provide the Zoological Station with live fish for itself as well as for the Universities, while we can also contribute to the food for the seals of the Texel Museum, which are of value to us for study. – For the rest, the success of kom-fishing depends on many circumstances. A kom is a heavy structure, which, once built, cannot easily be removed to another place. In this connection it may be mentioned that in July in one kom, put up in 1959 in a “warm” place, no less than 18 sting rays, *Trygon pastinaca*, were caught, whereas in another kom, put up in a “cold” place, not a single specimen of *Trygon* was caught. The sting ray is a genuine southern species, entering the North Sea through Dover Strait in summer.

It should be mentioned that Mr. VAN HEEL spent a few months of 1959 in reorganizing the registration of animals brought in by fishermen, thereby greatly facilitating the survey of this system.

Just as in previous years the hydrographical part of the work was carried out by Mr. POSTMA and Mr. DUURSMAN.

Mr. POSTMA continued his research near Ameland, which was already mentioned in the previous Annual Report. In it the processes which play a part in the accumulation of suspended material in the Waddensea were studied. The work in 1959 was extended to include the area near Den Helder.

The most important result of this investigation is that it is now possible to give a more detailed description of the way in which material in suspension, especially that below a size of 64 microns, is accumulated in the inner part of the Waddensea. Around high water, when the current velocity has dropped to a very low value, practically all material in the Waddensea settles. It is again stirred up by the ebb current, but not before this has reached a velocity considerably greater than that of the flood at the time of settling. Therefore, the ebb cannot take the material as far back as the flood has brought it in. One might expect that at the end of the ebbside a similar effect occurs, which more or

less nullifies the effect of the flood, but this is not the case since during low water a great deal of material remains in suspension. This difference between the effect of high and low tide is in its turn caused by the fact that at high water the current velocity is for a much longer time below a value allowing sedimentation than it is at low water. The latter difference between high and low tide is ascribed by Mr. POSTMA to 1) the decrease in average current velocity from the estuaries inward, and 2) the asymmetry of the tidal curves in the small gullies, in which the current maxima occur nearer to low water than to high water. Mr. POSTMA gave a short lecture on the results of his work at the Congress in New York.

In the Annual Report for 1957 Mr. POSTMA's contribution was mentioned, which made part of the results of the Snellius Expedition. It was published in 1959 under the title "Chemical results and a survey of water masses and currents".

Mr. DUURSMA, in 1959 still in the service of the Netherlands Organization for Pure Research, completed his research on the quantity and origin of dissolved organic substances in sea-water. A short contribution on the data concerning the Atlantic Ocean appeared in the *Deutsche Hydrographische Zeitschrift, Ergänzungsheft Reihe B*, nr. 3. They were already discussed in the Annual Report for 1958. Another summary on the data from the Atlantic Ocean was given in a short paper read in New York. The complete results will appear as a doctor's thesis.

From a study of the samples collected in the North Sea near the lightvessel Texel it appeared that quantities and relations of dissolved C, N and P show obvious seasonal variations, which are connected with fluctuations in the plankton quantities. The variations in C and N found in the Ocean fit in with these seasonal fluctuations.

In the Waddensea the decomposition and formation of dissolved organic matter are not directly demonstrable, but they may be determined indirectly from the data on phosphor, collected some time ago by Mr. POSTMA. In the Atlantic Ocean and the Norwegian Sea the origin and relative age of the dissolved organic compounds could be approximately determined.

Passing on to the non-scientific part of the Annual Report we may first of all say something about the plans which in 1959 held priority: those relating to the possible removal of the Zoological Station to the island of Texel.

Early in 1959, thanks to the kind cooperation of the owner, Mr. J. S. VAN LEEUWEN, 3 hectare ($7\frac{1}{2}$ acres) of land could be bought in the polder 't Horntje in Texel, just opposite the place where seawater of good quality might be pumped in from the sea and close by the place where

the new ferry harbour for Texel is going to be built. Furthermore, both Rijkswaterstaat and the State Forestry promised their cooperation in making over about 2 ha (5 acres) of land (largely dunes) near the same spot. At the same time, however, Rijkswaterstaat informed us that the use of the ferry-harbour would not be permitted for other than ferry-boats. As a result, the matter came to a standstill, a condition now lasting for several months already. It is very much to be hoped that eventually this problem may be solved. If the Station's vessels cannot moor in the vicinity of the Station the southern point of Texel is of no interest to us.

In the meantime the program for the new Station's requirements is at an advanced stage of preparation; it was drawn up by all members of the scientific staff, while Mr. DE BLOK worked out the details in close contact with Mr. J. D. KOSTER of the State Public Buildings Service. The latter also played an important part in the discussions with Rijkswaterstaat and other bodies. For the rest, these plans took up a lot of time of the council members of the Netherlands Zoological Society (especially its President), a point which cannot be stressed too much.

The acquisition of 3 ha of land in the polder 't Horntje included the home of the above mentioned fisherman, H. A. BEUMKES. Early in 1959 BEUMKES entered service with the Zoological Station, so that his work will be continued on behalf of research and of the provision of the universities with animals for study. His motor-flat and nets were also taken over by the Station.

The old caravan which served as a dwelling and observationpost to Mr. DUDOK VAN HEEL and his family during the porpoise-investigation in North Texel in 1958 was taken over from its Texel owner and in the end of May it was moved to 't Horntje to serve as a provisional shelter.

As mentioned before, the plans for building a new Station are the outcome of a 15 years-scheme for extension of the Den Helder research. Since building this new institution will take some time, and since the personnel in the meantime will increase, the Zoological Station will have to face a transition period in which lack of space will be serious. In the previous Report we mentioned already that a house in the town was fitted up to serve as a students' lodge, so that the former one, the "Potvis", could be turned into a workshop. The new students' lodge was ready for occupation in 1959. It is a large, deep, two-storeyed building, two rooms wide, with a cellar, and a loft which was turned into a dormitory. Girls and boys have separate bedroom- and washing-floors, and there is a communal dining- and livingroom in another floor with kitchen. There is room for over 30 people. Since the 6th July a married couple is in charge; they live in the building. The house had

also a tumble-down garage, which at the end of the year was thoroughly done up and now shelters the Ford-van. This means at the same time an end to our garage-problems. The total cost of acquisition, rebuilding, repairs and furnishing of house and garage amounted to *f* 55.000.—, a sum which was placed at our disposal by the Ministry. In early summer the old Potvis was turned into a workshop for the instrument-makers and carpenters. On the occasion an A.I. lathe (cost *f* 12.500.—, furnished by the Ministry) and a Shop Smith sawing-machine of *f* 1.300.— were bought. The former fitting-shop in the main building was turned into a chemical and physiological laboratory. Part of the top-floor in the main building was turned into a storehouse for glasswork and other material. In spite of all these alterations the lack of space is serious and it will appear from the next Annual Report that the research on problems of radioactivity will be accommodated in a building next-door.

As concerns the upkeep of the building we must mention that the zinc roofing, in so far as it had not been renewed since the war, was renewed in 1959 and that the renovation of the electric mains was completed.

The Max Weber in 1959 made again 125 navigation days. The vessel was employed from 19th May to 6th June in the Waddensea near Ameland, from 2nd to 10th July it was put at the disposal of river-research connected with the study of the Biesbosch area, from 3rd to 13th August it was used for research in the Zandkreek (province of Zeeland) on behalf of the Delta Research Department, and just as in 1958 it was for one week (24th to 29th August) put at the disposal of the Netherlands Junior Naturalists for a study on the ecology of waders and the invertebrate fauna of the Waddensea.

We stated already that the motor-flat of BEUMKES was taken over by the Station so that the Station now also has a boat in Texel. On behalf of the driving into the bottom of posts for kom-fishing a petrol-engine and Sihi-pump were bought for this flat.

To the instrumentary of the Station were added in 1959 an Ott current-meter (*f* 1900.—), 3 microscopes Meopta for the courses (*f* 1095.—), one Reichert-microtome (*f* 1300.—), one Victor calculating-machine (*f* 1700.—), a Philips salinity-meter (*f* 428.—) and some photographic apparatus. This instrumentary means a great asset to our research, a fact not the least holding for the calculating-machine.

Circumstances in the library are much better now, since in 1959 the number of steel cases could be increased. The periodicals, which used to be scattered over various rooms, have now all been brought together in alphabetical order in the library. The room was also provided with a gasojar.

For the library we bought, besides some handbooks, numbers 36-45 of the Supplements to the Bulletin biologique de la France et de la Belgique, a periodical which now is complete in our library. In 1959 f 600.— was spent on binding. Readers should note that reprints will be tankfully received. We want to express our sincere gratitude to those who are already in the habit of sending them.

There were not many alterations in the staff. New appointments were: the instrumentmaker A.W.SCHREURS, who entered service on 11th May, the assistant-laborant Miss G.DIJKSTRA on 1st January, and a male labourer for cleaning and other jobs, A.GERNLER, on 1st July. The appointment of BEUMKES in the middle of January was mentioned above. The assistant-analyst Miss S.S.STEINFORT SCHAAP left service on 1st August, the charwoman Mrs.T.JANSEN-VISSER on 13th June. It should be added that in the last quarter of 1959 the Ministry put money at our disposal for the appointment of two scientists, a biologist and a chemist, for the study of the influence of radioactivity on life in the sea. However, no appointment resulted in 1959, as a biologist could not be found and the chemist could not enter service before 1960.

In March Mr. POSTMA attended a geological excursion of a week's duration, conducted by Prof.J.BOURCART, along the coast of Brittany. On 19th and 20th June Mr. VERWEY attended the opening of the new Biologische Anstalt in Heligoland. He also visited, together with Mr. POSTMA and Mr.DUURSMA, the International Oceanographic Congress, held from 30th August to 12th September in New York. This visit was combined with a visit to a number of American marine institutes, viz. those of Boothbay Harbor, Maine, the Woods Hole Oceanographic, Marine Biological and Fisheries Institutions, the Narragansett Marine Laboratory at Kingston and Narragansett, Rhode Island, the Bingham Oceanographic Laboratory, Yale University, Conn., Loosanoff's Shellfish Laboratory at Milford, Conn., the Chesapeake's Bay Institute of the John Hopkins University, Baltimore (Maryland), the U.S. Navy Hydrographic Office, Division of Oceanography, Washington (D.C.), the Fish and Wildlife Service, Washington, which has headship over several of the fisheries laboratories visited, the Oyster Laboratory at Annapolis (Maryland), the State of Maryland Chesapeake Marine Biological Laboratory at Solomons, the Virginia Fisheries Laboratory, Gloucester Point, Virginia, and finally the institutes at Beaufort, North Carolina: the Fisheries Laboratory of the Fish & Wildlife Service including the Laboratory for Special Shellfish Investigations, the Duke University Marine Laboratory and the Institute of Fisheries Research of the University of North Carolina. Moreover, Mr. POSTMA visited Scripps Institution of Oceanography in La Jolla, California. Together with Mr. POSTMA, Mr. VERWEY also attended an inter-

national conference on the problem of discharge of radioactive waste, held in Monaco from 16 to 21 November. On this occasion Mr. VERWEY also visited the marine biological laboratories at Villefranche, Endoume-Marseille and Banyuls. In the absence of Mr. VERWEY his work was taken over by Mr. CREUTZBERG assisted by other members of the staff. It must be mentioned that also Prof. DE WILDE as a commissioner was much interested in the smooth running of affairs at Den Helder, not only in the period mentioned, but also during the rest of the year. He visited the Station on 11th April, 29th July, 20th and 27th August, 11th and 24th September and 19th October.

Visitors from abroad in 1959 included a.o. Dr. J. J. DE BROUWERE, Service for Scientific Documentation, Brussels, Prof. Dr. L. DE CONINCK, Ghent, Dr. YIU KEE CHAU, Fisheries Research Institute, Hongkong University, Dr. G. HEMPEL, Biologische Anstalt, Heligoland, Dr. A. C. GIESE, Stanford University, California, Dr. N. MARSHALL, Narragansett Marine Laboratory, Kingston, Rhode Island, Prof. Dr. O. KOEHLER, Freiburg, Dr. M. S. SARGENT, U.S. Office of Naval Research, London, Dr. A. M. SHEBETA, Cairo.

Cooperation with other institutions including the Laboratory for anti-fouling Research T.N.O., which since June 1958 is accommodated next door to the Zoological Station, left nothing to be desired. Mr. J. M. HOEKMAN, chemist-hydrographer with the Delta-Research Department of the Hydrobiological Institute, and Miss I. DE JONGE, analyst with this Department, left Den Helder on 1st March to start work in Zeeland. Mr. C. DEN HARTOG of the same institute left Den Helder on 1st May.

In 1959 the number of participants in the summer course was again small: 16 in all, of whom 12 came from Groningen, 3 from Utrecht and 1 from Amsterdam (Municipal University). To this course all members of the scientific staff devoted their best energies, while extra preparatory work was done by Mr. DRAL and Mr. DUDOK VAN HEEL. Furthermore, the Zoological Station had a 12 days visit by 13 graduate students from Ghent, Belgium, who attended a course by two of their own assistants with the help of members of the Station's scientific staff. Besides, Mr. I. KRISTENSEN and Mr. S. PARMA of the Physiological Laboratory of the University of Amsterdam gave a 5-days' course to 23 of their own students, while Prof. L. M. VAN NIEUWENHOVEN S.J., Miss J. F. M. GEELLEN and Mr. H. C. E. OOMEN gave a course of 2×4 days to 2×14 undergraduates from Nijmegen.

The total number of man-days, spent in 1959 in the Zoological Station by research-workers and course-participants, amounted to 1200. The average of the years 1947-1959 is about 1126 man-days.

The receipts from study material in 1959, including f 740.50 for

packing material, amounted to *f* 15.051.—. The net income amounted to *f* 14.310.50. Animals were bought for *f* 5.853.58, while *f* 3.788.90 were spent on packing material, preserving liquids, etc. The total expenses therefore amounted to *f* 9.642.48 and the surplus was *f* 4.668.02.

The receipts and expenses of the kom-fishery of Mr. BEUMKES do not make part of these sums. His motor-flat and nets were bought for *f* 7.000.—, paid in two terms of *f* 3.500.— each in 1959 and '60. The expenses for the 1959-fishing (the salary of Mr. BEUMKES excluded) were, besides, *f* 995.40. A sum of *f* 124.65 was received for fish sold in the fish-auction, but large quantities of live fish, brought to the aquarium, added to the profit of the supply of specimens for study, while other quantities were put at the disposal of the Texel Museum as food for its seals.

The expenses of the delivery van have been charged on the surplus of *f* 4.668.02. Of the 6100 km covered in 1959 about 600 or 10 % were directly connected with expedition of study materials, the remaining 90 % were for the greater part made in the interest of research and for local orders.

The total expenditure of the Zoological Station in 1959 amounted to *f* 235.269.23. Of this total *f* 147.211.10 was paid for salaries and social taxes, *f* 16.500.— for the General Civil Pensionfund and *f* 71.558.13 for the Station's running. Not included in the latter sum is an amount of *f* 24.213.95 for the new Student's home (for which *f* 29.910.08 was paid in 1958), of *f* 29.612.91 for the acquisition of land in Texel and some other expenditure there, and of *f* 6.000.— as part of the cost of the journey to America of Mr. POSTMA and Mr. VERWEY. The sum paid by the Netherlands Organization for Pure Research for the salaries of Mr. CREUTZBERG and Mr. DUURSMA is left out of consideration here. If this sum and also some extra-amounts are included, the total expenses were about *f* 320.000.—. It is clear that the Government does the utmost to help us in making up the arrears in marine research in the Netherlands.

Den Helder, February 1960.

J. VERWEY.

The Netherlands Zoological Society has issued the following publications, which are obtainable from the Director of the Zoological Station, Den Helder, at the prices given below:

Tijdschrift van de Nederlandse Dierkundige Vereniging

Series I, vols 1—7, 1874—1885, out of print	
„ II, „ 1—20, 1887—1927, partly out of print . . .	8,50*
„ III, „ 1—3, 1928—1933, partly out of print . . .	5.—
Supplement to vol. 1 (Ser. I), 1883—'84:	
Report on oyster research	6.—
Supplement to vol. 2 (Ser. I), 1888:	
Report on certain fisheries	6.—
Index to Tijdschrift, 1874—1909	1.20

Archives Néerlandaises de Zoologie, issued in cooperation with the Holland Society of Sciences at Haarlem:

Vols. 1—7, 1934—1947	22.—
„ 8, 1947—1951	25.—
„ 9—13, 1948—1958	30.—
Suppl. to vol. 3, 1938	10.—
„ „ „ 7, 1946	2.—
„ I, „ „ 10, 1953	8.50
„ II, „ „ 10, 1953	8.50
„ I, „ „ 13, 1958	40.—

Flora and Fauna of the Zuiderzee. In Dutch. 4°. 460 pages, 1922. Out of print.

Supplement to Flora and fauna of the Zuiderzee.

In Dutch. 4°. 258 pages, 1936 7.—

Changes in the flora and fauna of the Zuiderzee since its closure in 1932. In Dutch, with English summary. 4°. 359 pages, 40 figures, 11 plates and many maps and tables, 1954 . . . 15.—

De Biologie van de Zuiderzee tijdens haar drooglegging,

parts 1-6, 1928-1944 Per set 10.—
Per part 2.—

Mededelingen Commissie faunistisch onderzoek Zuiderzeepolders,

parts 1-2, 1949 Per set 1.50

Catalogue of the Society's library. 1907. 1924. Out of print.

*) Prices in Dutch guilders per volume, reduced prices for members. Postage extra.

